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NEW ZEALAND'S PLACE IN WORLD TRADE

The Henry Morley Lecture by

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New Zealand, delivered to the Commonwealth
Section in Mr. Taylor's absence by Mr. A. G.
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Commissioner, Office of the High Commissioner, on
Thursday, 12th February, 1953, with Dr. E.
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THE CHAIRMAN: I am very honoured this evening to be allowed to take the Chair at the third Henry Morley Memorial Lecture, but I am sure you do not want me to stand between you and the speaker. It is rather unfortunate that Mr. Douglas Taylor, who wrote this paper, is away at the conference of G.A.T.T. in Geneva and cannot get away because of government responsibilities, but we are most fortunate indeed to have Mr. Beadle with us as a very effective substitute.

I now call on Mr. Beadle to address you.

THE LECTURE

Nearly 120 years ago, from this very street where we are now meeting, a man of some stature in New Zealand's history published a book entitled *The British Colonization of New Zealand*. The man, Edward Gibbon Wakefield, was the founder of the New Zealand Company and was largely responsible for the decision of the British Government, in 1840, to annex New Zealand as a British



Two-tooth Romney ewes pasturing on Banks Peninsula, Canterbury

Colony. The New Zealand Company and the somewhat similar associations which settled Canterbury and Otago were not commercial enterprises designed to show a profit for their organizers, but nevertheless behind the formulation of these schemes lay the prospect that the new country would export products of use to the old and would grow to play an important part in the pattern of British world trade.

Wakefield's book was designed to persuade government and public opinion in favour of the early annexation of New Zealand, and it is significant that he laid great stress on the possibility of developing trade with the proposed colony. In the course of our survey of New Zealand's trading position, we shall have occasion to look at Wakefield's ideas and see how they have worked out in the passage of time; but it is sufficient at this point to take note of the fact that New Zealand's present very close association with the United Kingdom began, to some extent, through the possibilities of trade and, as will be seen as we go on, the trading link has brought our two countries closer and closer together as the years have gone by.

SPECIAL FEATURES OF NEW ZEALAND'S TRADE

The title of this lecture—"New Zealand's Place in World Trade"—may raise doubts in some minds and some might say that so small a country has such a minor share of world trade that it is rather grandiloquent to speak of her as having a place in world trade at all. Indeed, when comparison is made with the massive

trade figures of the United Kingdom, it must be admitted that New Zealand's total overseas trade is small. Nevertheless, there are some unique features about New Zealand trade which are of interest not only to professional economists but also to the merchants, manufacturers and the general public of this country. The British people, indeed, are vitally concerned with New Zealand, for we supply such a large proportion of their rations of butter, meat and cheese.

The outstanding feature is that New Zealand has the greatest value of trade, per head of population, of any country in the world. In 1951 our total visible trade, imports and exports, amounted to £454 million, or £233 10s. *od.* per head. The comparative United Kingdom figures were £6,620 million, or £131 10s. *od.* per head; so it will be seen that even if our total trade volume is relatively small we do have a more vital interest in international trade than most countries. The second feature is that, for its overseas income, New Zealand depends upon the export of a few agricultural commodities directed largely to a single market. The United Kingdom market is so important that scarcely any aspect of our trade can be discussed without reference to the trade relationship between the two countries. We have been linked contractually by preferential tariffs and by bulk purchase agreements for three of our chief exports—butter, cheese and meat—for a number of years. These agreements have aimed at producing stability, but in a period of severe fluctuations, such as we have experienced since the last war, bulk purchase agreements bring problems for both buyer and seller. These problems will be touched on later.

A remarkable illustration of the closeness of the economic ties between New Zealand and this country was provided a few months ago when the New Zealand Arbitration Court decided against a general increase in wages, stating in its judgment that while the economic and financial position of the United Kingdom was so perilous a substantial increase in wages was undesirable. Surely few countries have ever consciously conducted their own internal financial policies so positively to avoid placing strain on a trading partner's economy.

A third unique feature arises from the fact that there has been practically no change in our main source of income from the same products for the past fifty years. This does not mean, however, that the economy is static. Agricultural output and secondary industries show continuous development. Finally, New Zealand provides a very interesting economic illustration of a country entirely dependent on the export of primary products for its earnings of overseas exchange, whose internal financial position is consequently vulnerable to fluctuations in the prices of these products, but one which is making a real effort to ensure some stability in the face of these difficulties. Nevertheless, it has been well said that the export market is the determining factor of New Zealand's economic life. Before studying this economic life in greater detail, it might be helpful to consider briefly New Zealand's geographical position.

IMPORTANCE OF AGRICULTURE

New Zealand consists of two main islands with a total area a little greater than the United Kingdom. Situated in the South West Pacific, in temperate latitudes,

it has a climate well suited to agriculture on the European pattern. Its distance from other land masses, its narrow size, high mountain ranges and long coastlines lend themselves to plentiful rainfall but, nevertheless, there is generous sunshine, giving suitable soil temperatures as well, and the combination of the two leads to the provision of New Zealand's chief asset which is just plain, but believe me, very important, grass. Of the country's 66 million acres, 43 million are farmland, of which three quarters are in grass. New Zealand's dependence on good growth of grass is shown in the fact that we export well over £200 million of grass each year in the form of butter, meat and cheese. New Zealand farmers have been described as the best grass farmers in the world and certainly the Department of Scientific and Industrial Research and the Agricultural University Colleges have done much to ensure that this description remains true. New Zealanders have pioneered in the practice of extensive application of phosphatic fertilizers and the development of grasses and clovers for the efficient use of these fertilizers. We were one of the first countries to use the aeroplane to distribute fertilizers, particularly in the back hill country, and it may be that we are as far ahead as any other country in the application of this new development. Our Chairman, as a distinguished leader of New Zealand scientific thought, knows well that research is still going on with the principal motive of ensuring that New Zealand's main asset—its agricultural and pastoral industry—continues to progress.

Wakefield and his contemporaries, as his book shows, considered that New Zealand would be an excellent farming country and would also provide abundant timber and flax. They anticipated that it would have a rich fishing industry and be the centre of an important whaling and sealing industry. They were quite confident that New Zealand would provide a plentiful supply of minerals and they even went so far as to imagine that it might in future become not only a Britain of the south in social patterns but a highly developed manufacturing and trading country occupying the place of Britain with Europe in the South Pacific and directing its trade to Australia and the Far East. New Zealand history is yet too short to write off this destiny completely but it seems unlikely, for Wakefield and many of his contemporaries miscalculated the country's resources. They were confident that the country had great mineral wealth which would provide the foundations for thriving manufacturing industries, whereas, in fact, New Zealand lacks supplies of most useful metals. The early forecasts were, of course, correct about New Zealand's future as a farming country, although flax and timber have proved secondary products compared with the huge exports of wool, meat, butter and cheese. But then Wakefield could not foresee the immense contribution which refrigeration was to make to New Zealand's economy in making possible the transport of perishable foodstuffs. Time does not permit a description of the development of refrigeration, which is a story all on its own—nor of the gold rushes which brought wealth and a vigorous population to the country.

GROWING MANUFACTURING INDUSTRIES

From what has been said so far you may have gained the impression, one

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that is found to be widely held, that New Zealand is simply one great farm. That is, however, far from true, for the internal economy is much more complex. Secondary industries designed to provide many of our demands for consumer goods and light capital equipment have of recent years made rapid progress.

In 1881 the only industries with a total capital above £200,000 were those connected with saw-milling, gas-works, grain milling, brewing, printing and coal mining, but others worth noting and which have subsequently grown in importance are the woollen, footwear and clothing industries, and the manufacture of agricultural implements. By 1890 frozen meat production had become the largest of our secondary industries, but apart from this change there had not been much alteration in the pattern of secondary development, although there had been substantial increases in the capital of established concerns. During the Second World War, when United Kingdom factories were turned over almost entirely to war production and New Zealand herself was facing possible invasion from the North Pacific, it was necessary to transform and expand our factories to produce large quantities of Service equipment, including cloth, small arms, bren gun carriers, mortars and bombs. The small ship-building industry was also enlarged to turn out numbers of small naval craft; and thus, at the war's end, New Zealand had a greatly extended manufacturing capacity available for peace-time production and, moreover, precision engineering had been established.



Pareora freezing works, Canterbury

A stimulus of a different kind was given in the depression years of the early 1930s. New Zealand suffered almost as badly as any other country, for we are, as has been pointed out, heavily dependent on exports of farm products for our overseas income and internal prosperity. In the depression, prices paid for New Zealand primary products were so low that the whole financial structure of the country was in danger of collapse. Unemployment was heavy and many believed that the only way to ensure that New Zealand was never again subjected to such dire social distress was to provide work in secondary industries so that we should never again be so entirely at the mercy of fluctuations in world prices for our primary products. Consequently Parliament sought means of stimulating new industries, but before much had been done New Zealand began to face a severe shortage of overseas exchange, and at the end of 1938 it was considered necessary to introduce import control to ensure that what overseas funds we had were spent on buying essential goods and equipment. The protective effects of import controls are well known and there is no doubt that they did shelter New Zealand manufacturers and assisted the expansion which took place in the war and post-war years.

To-day New Zealand industries not only consist of woollen mills, saw-mills, clothing factories and footwear factories but include the manufacture of tyres, plastics, paints, radios, refrigerators, electrical equipment, car assembly and kraft paper manufacture; indeed, most types of light engineering are now undertaken in New Zealand. The shortage of base metals and the limited domestic market provided by a population of two million people have so far precluded the establishment of heavier industries.

The trend toward greater self-sufficiency for many consumer goods will undoubtedly continue but it is not anticipated that this trend will affect the volume of imports, although these will consist more and more of the heavier types of goods and equipment we cannot yet make ourselves. We do not export many manufactured goods, other than processed foodstuffs, and for decades to come the bulk of our exports will remain primary products, although an important contribution may come from industries, such as electro-chemical industries, based upon supplies of cheap electric power.

NEW ZEALAND'S IMPORT TRADE

As the nature of a country's imports depends to a large extent upon its social development as well as its economic position, it is worth pointing out that New Zealand is a prosperous country with a very high standard of living which does not vary greatly between rich and poor. We have not very many poor people, nor have we many with incomes above £3,000 a year, and the majority have incomes ranging around £500 a year. New Zealand is thus a competitive market for good quality consumer goods.

Our main imports are textiles, metals, metal manufactures, industrial, agricultural and electrical machinery, tractors and vehicles, oils, foodstuffs, drugs, chemicals and base materials for fertilizers. There are, of course, hundreds of commodities imported but these groups show the wide variety of goods we



Wellington Harbour and waterfront, with Oriental Bay in the foreground, from Mount Victoria

need. With railways, public works and hydro-electric programmes in government hands, government imports are also important. At this moment, for example, Britain is supplying much of the machinery for huge projects designed to more than double our hydro-electric production. But for an illustration of import needs, let us look at what is required to extend New Zealand farmers' output. It has been estimated that to raise 200,000 acres of country to full production requires 20,000 tons of fertilizer at an applied cost of £300,000 per annum. Wire is needed for fences; the estimated cost is £600 per mile. The farming area will also need machinery, such as tractors, milking machines, shearing machines; additional transport facilities may be needed, and new roads, trucks and port facilities. More power will be needed for the machines, more building materials and so on. All these demands will greatly influence our imports as our farm production increases.

BRITISH SHARE IN THE MARKET

What is the position of the United Kingdom in this pattern of New Zealand's trade? In any consideration of this, there are two factors which must be emphasized. There is first of all the purely competitive business aspect which shows itself in a long history of business relations between our two countries,

with most United Kingdom manufacturers strongly represented in our country and keen to do business with us, coupled with the fact that, as the United Kingdom is our best customer, we look to her for many of our supplies. The course of business is guided also by tariff considerations and in the New Zealand Tariff there is a British Preferential Section which gives a substantial margin of preference to many types of British imports. But the business angle is only one side of New Zealand's trading relationship with the United Kingdom. It is, I think, appreciated in this country that New Zealand yields to no section of the British Commonwealth in its loyalty to the Crown and in support of the United Kingdom whenever difficulties arise. This sentiment, if it can be called that, arises not only from the fact that our European population is almost entirely of British origin but also because for many years our sense of isolation was rendered less conscious by the strong ties we had with the United Kingdom, and especially with the Royal Navy. Such conditions lead, of course, not only to sympathy with Britain in troubled times but also to a ready acceptance of British goods whenever they compare at least equally with products of other countries.

The dollar shortage which has existed since the end of the war has given British exporters an assured market in New Zealand, for American and Canadian manufactures provide the greatest competition to the United Kingdom. In the years immediately after the war our import licensing policy gave out-and-out preference to imports from the United Kingdom, and it is only since the establishment of the European Payments Union that other "soft" currency countries have had the opportunity of attempting to compete on more equal terms. Although the resultant increased competition, particularly from Germany, must be noted, the United Kingdom has for so long been established in the New Zealand market that, provided its manufacturers can provide their usual high quality goods at competitive prices and with good delivery, they should not lose support or goodwill. But there has been some criticism of lack of servicing facilities and sales drive behind some of Britain's latest exports, for example, behind such equipment as heavy tractors and farm machinery in which the Americans have had a long lead. There may nowhere be a more favourable atmosphere for the reception of British goods than exists in New Zealand but those goods must be sold in competition with others. In other words, British manufacturers must not expect their goods to sell themselves.

BULK PURCHASE AGREEMENTS

Although the New Zealand market is quite important to the United Kingdom, it is only one of many. To New Zealand, however, the United Kingdom market is extremely important and one that we cannot possibly afford to lose. Until the time of the Ottawa Agreements in 1932, there had been quite severe fluctuations in the prices paid for New Zealand products in the United Kingdom, and it was not until these Agreements were negotiated that an attempt was made to create long-term special conditions for New Zealand products here. The Ottawa Agreements gave us preferential treatment but did not do away with price fluctuations. At the end of the war the United Kingdom was desperately

short of food and looked to New Zealand to increase its exports. The New Zealand farmers, much as they wished to help, remembered the lesson of the depression when the more they produced the lower the price paid for their products. They sought, and eventually obtained, a guarantee that, were they to increase production, they would not suffer through falling prices. This guarantee took the form of bulk purchase agreements between our two Governments for the purchase of New Zealand meat, butter and cheese, tallow (now free) and certain milk products. These contracts, which were originally negotiated for seven years, provided that, except in exceptional circumstances, the price to be paid to New Zealand producers for these food products would not vary more than $7\frac{1}{2}$ per cent either way in one year. With this guarantee for so many years ahead, most New Zealand farmers were prepared to extend their production.

The present bulk contracts with the United Kingdom expire in 1955 and, therefore, in the next eighteen months both countries will be considering future policy. On the New Zealand side there is no doubt that the contracts have tended to ensure stability and have given producers sufficient confidence to undertake capital development which will begin to show its full effect about the time the contracts are expiring. To the United Kingdom they have brought assured and cheap food supplies at a difficult time. These have been very important advantages to both countries, but there are one or two problems associated with the contracts. The biggest is that general market conditions have fluctuated so severely in the last two or three years that in the minds of some people the contracts, with their provision for only minor alteration in prices, have not been able to keep pace with changing conditions. When this happens, it can lead to misunderstanding and hard feelings on both sides; but fortunately, the relationship between New Zealand and the United Kingdom is such that these differences are minimized.

Secondly, the contracts have had the disadvantage of stifling competition. Whether New Zealand would have been better off in the years of the contracts if there had been free competition is something that can never be fully proved; in looking at prices of butter and meat in other countries, some farmers have undoubtedly taken the view that New Zealand would have done better if her products had been sold on a competitive basis. Perhaps the most important difficulty so far as New Zealand is concerned arises from the alteration in her terms of trade, which has been brought about by the general rise in prices throughout the world. The problem which faces New Zealand at the present time is that the terms of trade for butter and meat have fallen because money now received for the export of one ton of those products will not buy as many goods as the amount received for a ton would have purchased two years ago. When these contracts end and consideration is given to their renewal, both New Zealand and the United Kingdom negotiators will try to foresee the price level for foodstuffs in the next five or seven years, or whatever the length of the new contracts may be, and New Zealand will also be concerned about the price level of the products it will wish to buy in that period.



*Karapiro hydro-electric station: dam, power-station
and spillway, with out-door station at top right*

WIDE PATTERN OF TRADE

The trade relationship between the United Kingdom and New Zealand has been discussed at some length but this is inevitable, for in 1950, for example, New Zealand purchased 60 per cent of her imports from the United Kingdom and the United Kingdom took 66 per cent of New Zealand's exports. Nevertheless, trade with other countries is not without importance. We have, in the past two years, been able to provide the sterling area pool with a small dollar surplus; this has been achieved only by cutting down purchases from the dollar area to a minimum of essential needs and expanding as far as possible our exports to Canada and the United States. We have been disappointed to find that the United States market has not been freely open to us; we had high hopes of expanding our exports of dairy products but have found that we cannot export any butter at all to the continental United States, nor to Hawaii, which was a traditional market, and we are subject to quotas there for our exports of cheddar cheese. In association with other affected countries, New Zealand has protested vigorously in G.A.T.T. and elsewhere about the existence of these restrictions and we hope that the new Congress will see fit to remove them. It is axiomatic that we cannot expand our trade with the dollar area, nor restore our reserves of gold and scarce currencies if the countries concerned will not allow our goods entry.

We have close trading links with Australia, our nearest big neighbour,

1,200 miles away across the Tasman Sea. We have nearly always had a trade deficit with Australia and this is only to be expected as she produces many of the things we do and, therefore, finds little to buy from us, while we can look to her for steel, machinery and a host of manufactured goods. Australia's rapid industrial expansion, especially in the last twenty years, has made it improbable that we will, so far as we can see, ever reach a state of balance in our trade with her but, after all, as long as we share sterling as our trading currency there is no necessity that we should, and it is in the best interests of the Commonwealth that there should be multilateral trade.

These, then, are our chief trading partners, the United Kingdom first, Australia, the United States, and Canada. New Zealand has not, however, shut its eyes to the possibilities of expanding trade with other countries and in particular looks to the north to see in the greatly populated areas of India, China and Japan potential markets of the utmost importance. Through the Colombo Plan, New Zealand is associated in an endeavour to assist the Asian countries towards raising their standards of living and this will lead eventually to expansion of trade.

EFFECT OF EXCHANGE RESTRICTIONS

No discussion on trade would be complete without reference to New Zealand's own financial position. Much of the development of our country in the past was brought about through capital supplied by the United Kingdom. Payment of interest on these borrowings was a substantial fixed element of the invisible expenditure side of our balance of payments and in recent years an effort has been made, not only to forgo borrowing from overseas, but also to pay back as much as possible of what has been borrowed in the past. Whether this process can continue is now being discussed. No difficulty should be experienced in obtaining any loans required for the substantial development still to take place, for New Zealand, because of her resources, must be considered a very sound debtor. As long as New Zealand had a surplus in her balance of payments and the terms of trade remained favourable, she could, by careful internal financial policy, arrange to supply much of her own capital requirements. In the past year, however, New Zealand has run into balance of payments difficulties which, although tackled vigorously, have not yet been overcome. In common with most other countries, New Zealand was affected by the boom in raw material prices immediately after the outbreak of war in Korea in June, 1950, when the price of wool—at present our most important export—rose to an extremely high level. The boom in raw material prices and the subsequent reversal have brought problems to the whole sterling area. The high wool prices had a strong inflationary influence inside New Zealand, but prompt action was taken to neutralize some of the increased purchasing power by blocking, in frozen accounts, a portion of wool farmers' receipts. Nevertheless, these high prices did lead to a greatly increased demand for imports, but during the time lag between the receipt of increased income and the subsequent import demand, wool prices fell. Imports were consequently of greater value than exports, and

the reserves built up in the boom year began to decline rapidly. The National Government, which had taken the place of the Labour Government, was pledged to do away with import restrictions as quickly and as far as possible and to date has released some 75 per cent of our imports from control. Not desiring, therefore, to curtail demand by the use of import restrictions, it decided instead to ration exchange. United Kingdom exporters may think, and quite rightly, that there is little difference between the two systems; in either case their ability to export freely to New Zealand is hindered.

When the exchange restrictions were introduced, the method adopted was to allow New Zealand importers to spend in any way they wished in 1952 on unlicensed imports 80 per cent of the overseas exchange they had used in 1950. At the same time, provision was made for the importation of special categories of essential goods. To combat a tendency to spend the whole allocation on less essential goods, and yet still retain some flexibility and competition within the system, the Government decided that in 1953 the basic allocation would be cut to 40 per cent. Exchange rationing is not an entirely satisfactory method of curtailing demand, and whether it is better than straight-out import control is a point that could be debated at some length. Its main advantage is that it does provide importers with the opportunity of buying at least some goods which under a system of overall import control might be refused licences, and it therefore does ensure some healthy overseas competition inside the country.

TERMS OF TRADE IMPORTANT

Whether these exchange restrictions can be relaxed in the near future does not depend entirely on ourselves; as has been stressed, the New Zealand economy is very largely at the mercy of overseas market forces. Thus, if the price of wool goes up by an average of only 1d. per lb. throughout the season, our overseas income increases by £1½ million. New Zealand's undertaking, at the Finance Ministers' Conference in January last year, to attain a payments surplus with non-sterling countries must also be noted. How much we can buy depends, too, on the prices of the goods we wish to buy. If, as we hope, the prices of manufactured goods and capital equipment fall, we will be able to buy more, but the terms of trade have not moved in our favour in recent years, except during the period of very high wool prices, and they are now giving cause for concern. If the prices we pay for our imports rise in the way they have done in the past two years, and our meat, butter and cheese prices move upward only at the rate of 7½ per cent and wool prices stay at their present level, by 1954 New Zealand may be able to import only 75 per cent of what she did in 1951. Do not think, therefore, that we are adopting a tough policy if we ask the United Kingdom for higher prices for our exports.

The deterioration in the terms of trade may eventually force a substantial change in farm policy. New Zealand is one of the world's few great suppliers of butter and cheese, lamb and mutton, and the United Kingdom is by far the major market for these products. On the other hand, New Zealand is not a big supplier of beef and pork, for which markets normally exist in a number of

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countries. If the terms of trade are going to be relatively fixed for butter and cheese, lamb and mutton, by virtue of the fact that only one major market requires these goods, New Zealand might do well to give more prominence in production to beef and pork and other commodities, instead of virtually ignoring them. This would represent the simple business practice of pushing those goods on which the highest returns can be made as measured by the terms of trade.

The present exchange control is a severe handicap to British traders, although it must be said that in 1952 we still spent just as much on imports as in 1951, some 40 per cent more than in 1950. However, when the need for exchange restrictions has passed, import control policy will again be a very important issue. The domestic industries which have become established and expanded under the shelter of controls will look for alternative protection, and the New Zealand Board of Trade is already holding enquiries which may lead to tariff adjustments.

FUTURE TRADE DEVELOPMENTS

This talk has ranged widely and somewhat loosely over the whole New Zealand economy, but in conclusion something remains to be said about our future as a trading country. The very fact that we do grow essential materials required by the people of the world, and that world population is increasing at the rate of 20 million per annum, gives confidence that we will not lack demand for our products. This will be further assured if international action, by such means



Customhouse Quay, Wellington, looking towards Willis Street

as the Colombo Plan and 'Point Four', succeeds in raising world living standards, Price fluctuations will no doubt recur but time alone will show whether these can be smoothed out by commodity agreements as proposed at the recent Commonwealth Conference. New Zealand will certainly insist that any such agreements make adequate provision for price changes to bring export prices into line with import costs.

The importance of increasing the productivity of our grass lands has already been emphasized; further expansion of farm production can therefore be anticipated. Indeed, our greatest expert in this field has said that with the bringing in of undeveloped country and the application of still more effective methods of grass land culture, there is no reason why primary production should not be doubled. We are moving in the right direction. During the next twelve months we hope to increase our meat exports by 20,000 tons, our butter exports by 5,000 tons and cheese exports by from four to five thousand tons.

Some major developments in secondary industry can be readily foreseen. New Zealand has possibly the largest man-made forests of exotic timbers in the world, and these trees, like the grass, grow more quickly than in most other countries. We are now on the verge of an extensive woodpulp and newsprint industry which, as it grows, should enable us to make a real contribution to sterling area finance. Allied to the forestry development will be a growing chemical industry which will provide some of our extensive farm fertilizer requirements.

Our water power has a potential output of some 10 million horse power, and it is rapidly being harnessed to provide additional energy for those industries requiring cheap electricity. These resources may be supplemented by power generated from geo-thermal steam. It has already been proposed that these substantial hydro-electric power supplies should be used for the production of aluminium from imported bauxite, titanium from our own titaniferous iron sands and, perhaps, nitrogen for fertilizers. In association with these developments will come an expansion of our engineering industry, although so far ahead as can be foreseen we will still depend on imported heavy and complex capital equipment.

There is still great scope for the further processing of our present products. There may be distinct advantages to be secured by exporting our wool in scoured rather than greasy form. This would save shipping space, while by-products from the scouring industry would themselves provide valuable export material and form the basis of domestic lanolin production. In the course of time, we may also be expected to develop our own top-making industry and progress much further in the manufacture of textiles. The tanning industry working close to its raw materials will also grow in importance as will associated leather goods plants. A pharmaceutical industry, based on substances obtained from animal glands and by-products, will also come into being.

We may expect in the future to process more of our food products and to export them in packaged rather than in bulk form. Instead of concentrating on cheddar cheese as we have done, largely to meet United Kingdom requirements,



Lake Wanaka, Otago, South Island

we will undertake the manufacture of processed and other types. All these developments will take time but, in any assessment of New Zealand's future, they surely provide grounds for confidence in our continuing progress.

I am very conscious of having skimmed over numerous sectors of the New Zealand economy and of having left out altogether some very interesting features. Much more could be said, for example, about the co-operative marketing arrangements preferred by meat and dairy farmers, and about our system of guaranteed prices for farm products. Nothing has been said about internal and external transport and, of course, trade depends so largely on shipping. Air services are, however, growing in importance. It may surprise you to know that the airport which serves Wellington handled 18,312 plane movements in the twelve months ended 31st March, 1952, and that this total was only 4,300 less than the movements at Northolt in the same period. Nor has anything been said about our tourist trade. New Zealand is undeniably an attractive country with a remarkably wide range of beautiful scenery. The Tourist Department say modestly, but quite truly, that there is something for every taste—mountains to rival Switzerland, unique thermal regions, forests, rivers and lakes, with the latter providing wonderful fishing. New Zealand is the place to go for those who like an outdoor life in an equable climate. With the development of speedy air travel across the Pacific—Comet airliners will be operating shortly—we can be fairly sure that New Zealand will become one of the great holiday resorts of the world. We certainly hope that air travel will attract American tourists,

but we are always particularly glad to see people from the Old Country. We are going to be greatly honoured this year with a visit from the Patron and President of this Society, Her Majesty The Queen and His Royal Highness the Duke of Edinburgh. They can be sure of a really great welcome.

The Queen will see a young country where much remains to be done, but one where commerce and trade are already supremely important. She will find an intensely loyal people who are content to develop their political future in close associations with the homeland, a people whose trading links with the United Kingdom are very close indeed and who, for their part, would not wish it otherwise.

NEW ZEALAND TRADE STATISTICS

TABLE I

Exports by Commodity Groups

	1950	1951	1952 (6 months)
	£'000	£'000	£'000
Wool	74,653	128,176	59,521
Meat	32,302	31,303	23,301
Dairy Products	54,612	63,324	39,914
Other	22,186	25,328	14,841
TOTAL ..	183,753	248,131	137,577

TABLE II

Imports by Commodity Groups

	1950	1951	1952 (6 months)
	£'000	£'000	£'000
Food, Drink and Tobacco ..	19,457	23,960	14,929
Apparel	3,715	4,431	2,765
Textile Piece-goods and Manufactures	30,758	44,221	23,173
Oils, Greases and Waxes ..	11,741	12,829	11,667
Metals	11,890	13,621	15,492
Metal Manufactures (other than Machinery)	7,273	9,096	7,244
Machinery	27,586	31,941	23,505
China and Earthenware ..	2,329	2,571	2,761
Paper and Stationery ..	6,678	11,084	10,037
Chemicals and Fertilizers ..	6,993	8,197	5,961
Vehicles and Tires	13,816	20,402	22,429
Other	15,660	24,110	18,349
TOTAL ..	157,896	206,463	158,312

Note: The import figures for 1950 and 1951 are taken at current domestic value in country of origin, plus 10 per cent. The 1952 import figures are given on a c.i.f. basis.

TABLE III
Exports by Countries

	1950	1951
	£'000	£'000
United Kingdom	121,685	142,366
United States	18,387	28,859
France	8,077	17,854
Germany	5,950	8,836
Australia	4,779	5,111
Canada	3,557	8,565
Netherlands	3,419	3,262
Italy	1,900	3,847
Japan	997	3,845
Other Countries (and Ships' Stores)	15,012	25,586
TOTAL	183,753	248,131

TABLE IV
Imports by Countries

	1950	1951
	£'000	£'000
United Kingdom	94,897	110,720
Australia	19,030	21,215
United States	11,461	19,298
Canada	3,566	6,138
India	2,263	6,632
Indonesia	3,359	4,012
Malaya	1,459	4,069
Ceylon	1,985	3,801
Belgium	1,097	2,970
France	1,223	2,323
Germany	214	1,461
Other Countries	17,342	23,824
TOTAL	157,896	206,463

TABLE V
Percentage of New Zealand Exports in World Trade

	1949
Beef	10.4
Mutton and Lamb	63.2
Butter	34.5
Cheese	27.5
Wool	17.1

NEW ZEALAND PRODUCTION STATISTICS

TABLE VI

Value of Production in New Zealand

		1949-50	1950-51
		£million	£million
Agricultural Production	18.7	19.5
Pastoral Production	117.4	214.3*
Dairying Production	72.8	81.6
Factory Production (added value)	110.5	120.9

* The 1950-51 figure for pastoral production was affected by the very high wool prices ruling in that year.

At the end of the paper a film, This is New Zealand, produced by the National Film Unit of New Zealand and showing aspects of New Zealand life and industry, was shown.

DISCUSSION

THE CHAIRMAN: It only remains for me to express your thanks to Mr. Taylor for putting together such an interesting lecture, and for its simplicity and directness without recourse to the economic jargon normally associated with such a subject, and to Mr. Beadle in particular for the extraordinarily excellent way in which he gave the talk, clarifying to us the general picture of New Zealand trade relationships. I am sure, with no disrespect to Mr. Taylor, we could hardly have been better served had he been here himself.

I think it may come as a shock to some of us in England to find Mr. Taylor emphasizing that the terms of trade are still moving against New Zealand. Interestingly enough, I met a well-known Scots cattle breeder last week, and he was quite certain that we were getting a much better deal than that. He was sure in his own mind that New Zealand was being paid much more for its meat than he in Scotland was obtaining for similar meat. I offered to provide him with figures, but on second thoughts I do not know whether I should be doing him a kindness, because a farmer without a grouse is as unhappy as a dog without a flea!

There is one other interesting point. One realizes that the United Kingdom does need more meat and foodstuffs and raw materials, and New Zealand wants more capital equipment, machinery, and the products of the United Kingdom's heavy industries. Mr. Taylor has touched on some of the reasons for the slowing down of this desirable exchange. The United Kingdom manufacturer wants less hindrance to free exports to New Zealand, which are still limited, but I have a sort of feeling that there may be just as many hindering regulations and as much of the equivalent of licensing of food supplies from New Zealand in the United Kingdom as there are in New Zealand of imports from the United Kingdom of manufactured goods, and I think there may be a little dissatisfaction on both sides. I am not excusing either but I would argue for simplification and more flexibility. Why I say this is because I know that we can, in New Zealand, produce speedily and economically considerably more meat and foodstuffs for export to the United Kingdom. Personally, I am very worried as to whether, under present conditions, we shall increase at all, or at any rate as fast as the occasion demands, and I do not want the United Kingdom to be disappointed, as in my opinion she may well be jointly responsible with us if that happens.

Mr. Taylor did venture to prophesy what might happen to New Zealand's trade in the future. Well, there are all sorts of potentialities and possibilities: our pulp and our hydro-electric power applied to electrochemical industries and so on; but the possibility of fruition of those potentialities depends almost entirely on the trained men being available to bring those schemes to proper fruition. I would point out that there is a very important and invisible item of export from New Zealand, and that is the vigorous, educated and enterprising youth of both sexes who leave New Zealand in such relatively large and increasing numbers, attracted no doubt by the glamour and the apparent wider and higher opportunities in the United Kingdom, in Australia and in the United States. I think these enterprising young people are our most valuable export item, and it is an export item of capital. There is, particularly in New Zealand, perhaps not more than elsewhere but resulting from our expanding economy, a shortage of men and women able to provide the leadership in industry, in commerce, in government, and in learning that is so badly needed by a modern state. So that these hopeful lines of production for their fruition depend, I think, on some statesmanlike action to create conditions which will attract back to our shores these potential leaders and opportunities for their enterprise. One can see what happened in Canada where the flow is now practically reversed, and what happened in Scotland.

Well, there are many other aspects one would like to comment on, but I do want to express on my own behalf, and I am sure on yours, our deep gratitude to Mr. Beadle for coming to-day and for his most enjoyable presentation of the subject, and also to the Film Unit for providing such an excellent film for our further education and entertainment, even though it made some of us a little homesick.

The vote of thanks to the Lecturer was carried with acclamation.

SIR FRANK BROWN, C.I.E., (a Vice-President of the Society): Before we leave this room we should express our thanks to the Chairman for presiding, and for making such valuable comments on the lecture. In reference to his remarks about suitable entrants to his country I have no doubt that he is aware of the good work here of the Immigration Council which promotes the sending to New Zealand and other parts of the Commonwealth of those who are well fitted to contribute to the further development of industry and commerce in those countries.

I am sure you will join with me in thanking the distinguished scientist who has taken the Chair.

The vote of thanks to the Chairman was carried with acclamation and the meeting then ended.

THE GREAT SEAL OF ENGLAND

CORRIGENDA

Errors in Sir Hilary Jenkinson's paper on 'The Great Seal of England', as published in the *Journal* of the 26th June, 1953, should be corrected as follows:

p. 556 (lines 19 and 20): *delete* and it is in fact an impression of that reign which is seen in Plate V.

p. 559 (lines 24 and 25): *delete* —bearing a specimen at present unique—, and after reminds us of *insert* a specimen, at present unique, bearing.

p. 562 (lines 4 and 3 from foot): *for* 1269 *read* 1259; *for* 1259 *read* 1219.

MATERIALS HANDLING AND PROCESSING—PAST AND PRESENT

A paper by

L. LANDON GOODMAN, B.Sc. (Eng.), A.M.I.Mech.E., A.M.I.E.E.,

*Industrial Specialist, British Electrical Development
Association, read to the Society on Wednesday,
15th April, 1953, with Lieut.-General Sir Thomas
Hulton, K.C.I.E., C.B., M.C., General Manager,
British Productivity Council, in the Chair*

THE CHAIRMAN: Mr. Goodman has been closely concerned with materials handling over a number of years. As many of you will know, he has written an excellent book on the subject under the title *Materials Handling in Industry*, and he has read and published a number of papers on the same subject. He has also assisted in the production of a film which, I believe, has been shown at a meeting of this Society.

He is on the staff of that very energetic and enterprising organization, the British Electrical Development Association, as an industrial specialist. Some of you may remember that some time ago—I think about six months ago—he read a paper on this subject at the Industrial Productivity Conference organized by his Association. The paper was entitled "Materials Handling, a New Technology."

I am very pleased and honoured to be able to take the chair on this occasion, because my own organization, the British Productivity Council, is vitally interested in this subject, and I hope I may be allowed, after his talk, to make a few remarks regarding our special interest in it.

The following paper was then read:

THE PAPER

"If a man does not know to which port he is sailing
no wind is favourable to him" Seneca

INTRODUCTION

My paper sets forth an approach to industrial production matters by dividing all major industrial operations into two fields, namely, materials handling and materials processing, which are considered as two separate but closely related technologies. The constituent parts of these technologies are not all new, as the historical survey shows; the originality lies in the conception of integrating subjects, and of blending the two whenever and wherever possible. It will be appreciated that it is only possible to give a general treatment of these subjects in this paper because of their very wide coverage.

It has been demonstrated many times, if proof were needed, that it is vital to design for production and that process lay-out is of major importance. There

is still much to be achieved in this country. In many industries flow charts are unknown, planning consists of routing and there is no such thing as production research.

Some difficulties, too, which industry faces to-day in production matters, are due to loose terminology, lack of definitions and the vague relationship existing between various fields. The results are much trouble, confusion and loss of production.

If fundamental principles are known and appreciated, simple methods and devices will be employed which can give increases in production. Thus it is necessary that there should be qualified engineering personnel on the factory floor as well as in the design offices, and development work carried on in all the production fields. Lack of training often leads, for example, to over-mechanization and loss of flexibility.

An urgent need to-day is increased productivity and all industrial establishments, from the smallest to the largest, can increase their productivity if they apply this new way of thinking.

MATERIALS HANDLING

The movement of material is essential to human existence and the problem has been with man since the dawn of time. Even in the elementary handling of material there is generally more than one way of performing the same operation and it is not always obvious that care must be taken in order to find the most economical method.

Materials handling may be defined as the technology embracing the movement and storage of everything in or about an industrial establishment; for example, the movement and storage of raw material, of material between processes and of the finished material. It covers the services to the processes. The constituent parts are, *inter alia*, factory siting, factory lay-out, product design, motion study, mechanical handling, processing and the human factors. Planning and organization are important in practical applications. Thus materials handling is an integrating subject and the work of architects, structural engineers, lighting engineers and designers must be co-ordinated with that of the materials handling engineer.

There are many advantages of improved materials handling. Among these are: increased productivity, better utilization of premises, the up-grading of labour, reduction in the number of accidents both to personnel and to products, and a consistent level of production throughout the organization.

A materials handling study of an establishment requires a scientific approach by an engineer with the requisite training and experience. It is for this engineer to decide, for instance, whether the operation under consideration is suitable for hand labour unaided or whether at the other extreme electronic equipment can be used. If there is a labour content in the work he will bring in the motion study man as, for example, a qualified medical practitioner hands a patient over to the physiotherapist.

There are certain basic rules, methods and types of equipment from which

even the most complex schemes can be built up, but some plans involve a compromise between economic and human considerations.

When the handling of materials cannot be done efficiently by hand, mechanical equipment should be installed. The use of this equipment is termed "mechanical handling", and applies to materials handling and materials processing. The employment of mechanical handling equipment allows much heavier and or larger loads to be lifted at one time than is possible with manual labour alone; material can be stored to much greater heights; and the speed of the handling is increased.

MATERIALS PROCESSING

Materials processing can be defined as the technology covering those operations through which material passes during the course of manufacture and which change its form or composition or indicate its quality or quantity. Again, product design, machine design, factory lay-out, fuel technology, the human factors and handling are some of the constituent parts of this technology.

Examples of change of form : Machining or packaging.

Examples of change of composition : Heat treatment or pottery firing.

Examples of indication of quality : Testing of engines or inspection of parts.

Some operations may fall in the field of either the handling or the processing. For example, assembly when carried out entirely in a machine would fall under processing, but when done partly by hand would entail handling. Such border-line cases may be covered by the term "process handling".

Materials handling and materials processing are closely linked and should always be considered together because the type of processing often determines the method of handling and *vice versa*. The blending of the processing and handling leads to uniform flow and simplifies instrumentation and control of both the handling and the processing¹. Many benefits accrue: productivity is increased; process loading is much improved; inter-process stores are cut down to a minimum; bottle-necks are eliminated; the overall pulse of the organization beats more quickly and more regularly; the number of accidents to personnel and damage to products are reduced; and the utilization of labour and factory space are both improved.

The changes in production techniques of the Industrial Revolution were centred around the use of new machines, new processes and the availability of power. These factors made it possible to produce more cheaply and further to produce what hitherto had been impossible. The old methods of organization were no longer suitable, one change being towards the larger productive unit. 'But the fact is that in Western Europe' the machine had been developing steadily for at least seven centuries before the dramatic changes that accompanied the industrial revolution 'took place'.²

About 1500, embryo factory systems were operating for the making of arms, armour and cloth, e.g. Jack of Newbery's factory was working in Henry VIII's reign, and large-scale industry was growing steadily in this country during the sixteenth and seventeenth centuries. Other establishments existed at the end of the seventeenth century such as the Coalbrookdale concern. Walker's iron

works at Rotherham was a "vertical" organization with its own coal and iron mines. In 1775 Arkwright was able to send raw cotton into a mill and bring out the thread, almost the whole work being done by machines, and ten years later the first steam cotton mill at Papplewick was operating. Thereafter the development of industrial processing was fairly rapid in many directions.

In America Eli Whitney at the end of the eighteenth century built a factory to make arms having interchangeable parts, and he was followed a few months later by Simeon North, working on similar principles; another early example was Eli Terry's clock-making works. The famous Portsmouth block-making machinery commenced production around 1808. This factory used special machinery designed by Bentham and Brunel and had an output of 160,000 pulley blocks a year (for naval use) produced by 10 unskilled men who did the work previously done by 110 skilled men. Colt's Hartford works operating in 1848 was one of the first examples of mass production. During the years 1854-5, 10,000 shells a day passed through the Royal Laboratory, Woolwich, about which it was said that 'the shells never touched the ground'.

The coming of steam power allowed factories to be sited in towns and thus they no longer needed to straddle village streams, though industrial buildings had still to be designed with power-driven processes as close as possible to the engine room.

The first public demonstration of the transmission of electrical energy took place in 1873. This was the forerunner of the great surge forward which occurred with the advent of electrical power in lay-out, processing and handling. Shortly afterwards in the 1880s F. W. Taylor was experimenting with individual electric motor drives of machines from the work study and lay-out aspects.

The next major step was Ford's assembly line (1915) which was the start of the modern era of related processing and handling.

Until then the emphasis had been on the processing and the handling was relatively neglected. Even to-day it is common to see the latest type of machine tool being fed by hand with material from the floor, no other provision having been made.

THE DEVELOPMENT OF MATERIALS HANDLING

The development of handling was tardy because quantities of materials were small and abundant manual labour was available at low wages. When quantities started increasing and the cost of manual labour was rising the need for proper handling became more evident, but even then the introduction was slow.

Around 1750 the ironfounding firm at Coalbrookdale 'was producing about 100 tons of iron per week and this meant hand'ing six or seven times that weight of coal and ore, lifting it from the mines, conveying it a few miles to the furnaces and, after many handlings, getting the finished castings from the works to the wharves and thence to barges on the river'. 'In the early part of the eighteenth century, however, few (of these) mechanical aids were available and the muscular power of men and animals had to be organized to deal with the problem'.³

In the United States flour mills had started handling large quantities of corn,

and it was in this industry that the first fully integrated handling and processing scheme came into being, about 1785, which was followed only in isolated instances in the next 100 years.

Up to very nearly the end of the nineteenth century little was achieved in other industries. Cranes and other devices were used for lifting heavy loads, but many types of conveyors, for example, were known some decades before they were widely adopted in industry; they were occasionally employed to handle material in situations not readily accessible or where a close approach was hazardous, as in ovens, furnaces and sawing operations.

The introduction of conveyors and other equipment into gas works did not come until about 1890. Labour troubles were being experienced and it was realised even in those days that the greater part of the wages were for the simple movement of material. Duckham was compelled in 1891 on account of strikes at Millwall Docks to safeguard food supplies by introducing his pneumatic grain conveyor. Labour costs, labour troubles and the large quantities handled by centralized establishments were important factors in the introduction of mechanical equipment, though the benefits of properly planned materials handling apply equally to all sizes of establishments, as was demonstrated by Taylor.

F. W. Taylor (1856-1915) developed scientific management principles and advocated a scientific approach to industrial problems. A famous example showed that a labourer shovelling material moved a maximum daily tonnage if he used a shovel having a capacity of $21\frac{1}{2}$ lbs., for example a large shovel for a light material and a small one for heavy matter. When he first employed this principle there was a saving of 50 per cent of the handling costs.

F. G. Gilbreth (1868-1926) did fundamental work on the movements of operators, i.e. motion study, which is now part of materials handling.

MECHANICAL HANDLING EQUIPMENT

Water raising, mining and building provide a survey of the historical aspects of materials handling.

Mechanical handling devices at present known to have been used by the ancients were of simple form. Such devices were first employed possibly as a means of saving labour in the conveyance of water. The pulley was known in Nimroud for raising water in about the ninth century B.C. (Figure 1), but there is no record of its use in Egypt, even on galleys, before the Roman period. Egyptian buildings appear to have been erected principally by means of earth ramps, levers, rollers and sledges¹. Clarke and Engelbach² state 'the Egyptian could use primitive appliances with an almost incredible refinement and was a superb organizer of labour—therein lay his genius'.

Layard³ writes of the Assyrians that 'there are grounds for conjecturing that they were acquainted with mechanical contrivances which are either unknown to us or are looked upon as modern inventions'.

The swape or shadoof was used in Egypt from earliest times for raising water.

The shadoof was noted in China in about 330 B.C. It consists of a pole pivoted on the top of a vertical post, one end carrying a counterweight and the other a rope for raising the water vessel.

The chain of pots is presumed to have originated in Persia and consists of an endless rope or ropes to which pots are attached at regular intervals. The rope hangs down the well and the pots are filled with water at the bottom and discharged at the top, the motion of the chain being continuous.

One of the first conveyors was the Chinese chain pump which consisted of a wooden trough through which correspondingly shaped pieces of wood were pulled by an endless chain. The modern scraper conveyor works on the same principle.

The screw for raising water is attributed to Archimedes but it was at the end of the eighteenth century that Evans adopted the principle for conveying solids.

Hero of Alexandria described simple machines by which a given weight might be moved by a given (usually smaller) force, e.g. wheel and axle, lever, pulley, wedge and endless screw. Many lifting devices were known to the Romans and Vitruvius describes in Book X pulley blocks, pole cranes, jib cranes, pumps, chains of pots (Figure 2), and windlasses.

The next stage starts about the time of Leonardo da Vinci. Many types of equipment and methods were shown in his works and those of Agricola and Besson. From then on progress was rapid. Space precludes a detailed survey here of all the modern types and in the following sections a few of the more widely used are discussed⁷.

Overhead Runways

An overhead runway consists of a steel girder, usually of "H" section, on which runs a trolley. The load is suspended from the trolley either directly or by means of a hoist built into the trolley.

The development of runways is obscure. An early account is of extensive installations in the slaughter-houses of the Middle West in the 1860s. The runway

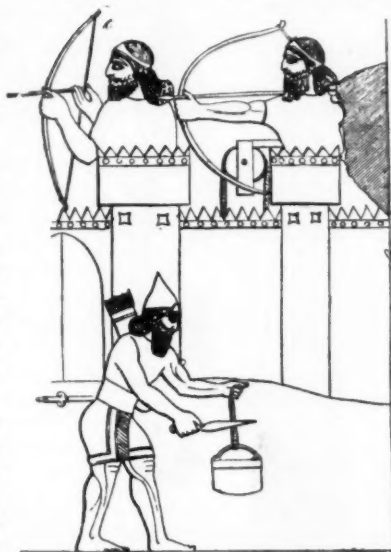


FIGURE 1. Part of a bas relief, showing a pulley and a warrior cutting a bucket from the rope, from a palace in Nimroud: circa 9th century B.C.

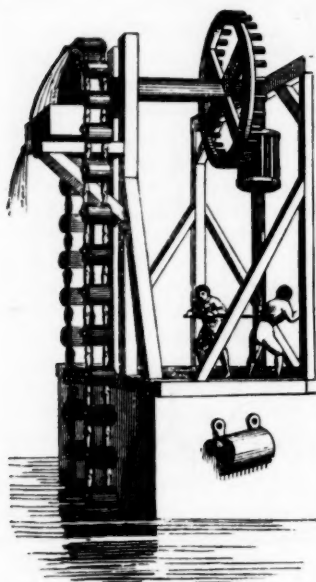


FIGURE 2. *Roman chain of pots, after Vitruvius*

Telfers are used where high speeds of operation are required and regular duties over fixed routes have to be performed. Figure 3 shows a telfer operating in a warehouse.

Cranes

Cranes were employed by the Romans probably mainly for building. Catheads, hooks and hand winches were used during the Middle Ages. Besson shows several types of cranes in one of his works⁸. In 1586 a wooden crane was installed at Woolwich Arsenal and wooden jib cranes are shown in Samuel Scott's (1702-1772) *Riverside Scenes*. The loads of these cranes were raised in some cases by treadwheels and alarming details are on record of the happenings when the load took control and ran back, no braking devices being fitted.

The design of cranes advanced rapidly during the nineteenth century. Steam power was soon employed, and greatly widened their use. Hydraulic cranes were suggested by Bramah (1802), and many were installed during this period. Electric drive came about 1890 and quickly superseded most other forms of motive power, allowing new developments in design to take place. To-day power driven cranes in industry are almost universally electrically driven.

principle was used in jib crane in design the nineteenth century when the jib arm was sometimes made of a flat bar on top of which ran a "monkey", i.e. a single wheel trolley, from which the load was suspended. Weighing on runways by means of a floating section of track was patented by Morrison in 1869.

Overhead runways have many uses in industry where lifting and/or intermittent transport is required and switches, turntables and drop sections can be incorporated.

The trolley and/or hoist may be hand-operated or electrically driven. In the latter case the current can be picked up in several ways, for example from collectors running on bus-bars at the side of the track.

A telfer consists briefly of a power driven hoist and trolley carrying a cage in which the operator travels, the unit running on a single overhead track. An early example, manufactured by Mather and Platt Ltd., was installed in Victoria Station, Manchester, in 1895, for conveying parcels between platforms.

Overhead Travelling Cranes

The overhead travelling crane can be traced back as far as Bodmer, who installed some in Manchester between the years 1830-1840.

This crane has a load girder with end carriages travelling on parallel gantry rails. The hoisting unit moves along the load girder. Thus there are three motions, namely, longitudinal travel, cross travel and hoisting, all or any of which may be power driven.

The use of overhead cranes should be considered where loads have to be picked up, transported and put down anywhere in a fixed area. Material must be brought within the gantry area by other means, or the crane girder can be designed to "latch up" with neighbouring runways or cranes. The load girder then consists of an "H" section rolled steel joist on which moves a normal runway trolley with standard lifting blocks. The trolley and blocks can pass from the crane girder on to a runway and vice versa at a latching point. A very flexible system of cranes and runways may be designed and Figure 3 shows part of an installation in a warehouse. There are many other uses as, for example, in loading bays and for feeding (i.e. servicing) processes.

Jib Cranes

Jib cranes are among the oldest type of crane known. During the nineteenth century their value for servicing processes was occasionally realized and they were sometimes installed near forges, boring machines and in similar situations.



FIGURE 3. *A telfer running on an overhead gantry crane*

There are many modern types. A useful design has a horizontal swinging jib of an "H" section joist. A hoist and trolley moves along this joist, thus the whole area swept by the jib arm can be covered. If such cranes are carefully positioned along the side of a shop so that the areas swept intercept one another, one crane can pick up material deposited by its neighbour. In this way material can be moved through a series of processes entirely by jib cranes, thus ensuring that operators are never held up waiting for the overhead crane.

Lifts

Hoisting devices for persons and goods have been mentioned from the earliest periods. Aristotle suggested vertical transport for passengers, and no doubt some such devices were used in Roman times. Many of the old monasteries of the Levant, as the Great Monastery of Meteora, were mounted on top of inaccessible crags and the only means of entry for men and materials was by rope and capstan operated by the monks.

A lift (possibly taking the form of a modern design with side guides) was working at De la Rue's London factory prior to 1846. The cage was operated by a belt drive from shafting. The safety mechanism was invented by Otis in 1852 and first used on a hand-operated lift, the first passenger lift so fitted being installed in a Broadway store in 1857. The first of Hart's continuous lifts was put in about 1883; the only example of this design in use to-day in England to the lecturer's knowledge is in a works at Acton.

Steam was used for driving lifts in 1862 in New York, and six years later the first direct acting hydraulic lift was installed in London. Early developments in electric drives resulted in installations in London and New York in 1889; the first automatic push-button controlled lift following in 1892. The latest advance is electronic control which was applied in 1948.

Modern lifts are of the electric traction type with multiple ropes and have geared drives for lifting speeds up to about 200 ft. per minute; above this speed gearless drives are used.

The installation and correct use require close study. Often lifts are not fully utilized. Careful planning of the methods of loading and unloading and usage pays rich dividends. Lack of planning causes delays at the various floors, and these have a detrimental effect on output.

When power trucks are used for loading lifts the wheels of a truck should not run on to the cage floor unless the lift structure has been designed to carry the extra weight.

Screw Conveyors

The screw conveyor consists of a power-driven helical core rotating in a trough and is made in lengths up to about 200 ft. A primitive form was used in the nineteenth century for conveying, mainly in flour mills. The ribbon spiral ('anti-friction') screw was invented in 1887 for handling materials liable to choke the normal worm.

Modern designs can handle all finely powdered, granular and lumpy materials

and semi-liquid and fibrous matter. Materials may be conveyed and mixed, dried or heated at the same time, and charging and discharging points may be positioned anywhere along the trough.

Roller Conveyors

A roller conveyor consists of parallel drawn steel rollers regularly spaced in an angle iron frame. The rollers can be power-driven or free.

Grant, of the Deptford Victualling Office, designed and installed, in 1833, one of the first powered roller conveyors driven by a steam engine. Nearly 70 years later Alvey-Ferguson originated the conveyor with free rollers. In this design the roller path has a slight gradient and the load runs downhill over the rollers.

Switches, turntables, lift and weighing sections can be incorporated in a lay-out. Roller conveyors can handle articles with a flat hard surface; other materials such as loosely packed bags and furniture can be placed on pallet boards on the conveyor. These conveyors have many uses, e.g. in storage racks, for loading lorries and for feeding processes.

Belt Conveyors

The belt or band conveyor consists of an endless belt which passes around two terminal pulleys, one of which is power driven. Surprisingly enough one of the earliest uses of a belt conveyor was for raising water in about 1780. Oliver Evans used a belt conveyor for carrying solid material in about 1785. He called this conveyor a 'Descender'. It operated by gravity, though he suggested that it should be driven if possible and used power drives in his later designs. An oven with a belt conveyor passing through it was patented by Admiral Coffin in 1810; the belt was of wire mesh and protruded at both ends of the oven. It was not until the middle of that century that a patent was lodged for a conveyor running entirely within an oven. Bodmer used an endless belt for conveying heavy material around 1830. Westmacott and Lyster developed belt conveyors for handling grain at Liverpool docks in 1866, and demonstrated that they used less power than the equivalent screw conveyors. Westmacott too patented the travelling tripper, for unloading at any point along the conveyor run.

Belt conveyors were used by women operators in the Creusot works of Schneider about 1860.

Troughed idlers came in 1896 invented by Robins, who also developed the stepped-ply belt. By the turn of the century belt conveyors were coming into general use; the first underground belt conveyor, for instance, was installed by Sutcliffe in 1906.

Belt conveyors to-day have many uses and vary much in length from a foot or two (feeding a machine) to many hundred yards (carrying spoil from a working). The belts are made from materials as diverse as cotton and steel. In manufacturing they are used, for example, in assembly work, inspection, filling, wrapping and bag and package handling. They are valuable for servicing processes and allow savings to be made at low capital cost. Troughed belt conveyors can carry

almost any bulk material, for example cement, ashes, flour, grain, salt, coal and coke.

The chapter on the development of the belt conveyor is not yet fully written, and these conveyors may be seen in the future carrying material uphill and down dale over hundreds of miles.

Chain Conveyors

There are many forms of chain conveyor; the only common feature is the use of a chain. The first chain suitable for conveyor work was drawn by Leonardo da Vinci (Codice Atlantico, Folio 357). Developments took place down the years leading to the chains of Ewart, Ley and Renold.

Slat Conveyors

Slat or apron conveyors are generally employed for heavier duties than those with which the belt types can cope. The conveyor consists of a number of slats or bars of wood or metal which are fastened to one or more driving chains. Usually the load lies on the slats.

An early example was Jucke's patent in 1841 of the chain grate stoker, although the idea had been suggested a few years earlier by Bodmer. Other examples occurred in the nineteenth century and to-day slat conveyors are widely used for many purposes. They are made in widths varying from a few inches to many feet, and can be at bench height or flush with the floor.

Overhead Chain Conveyors

Modern overhead chain conveyors can travel vertically at 90° as well as horizontally. It is only recently, however, that such designs have been successful; previously the maximum vertical bend was at about 45° to the horizontal. It therefore still is the practice to classify overhead chain conveyors in two categories:

- (a) Elevators: conveyors that travel vertically for all or most of their path.
- (b) Overhead chain conveyors: these travel mainly horizontally and may or may not be able to climb at 90° to the horizontal.

(a) Elevators

Elevators can be sub-divided into two classes, the first suitable for conveying bulk material, and the second for handling packages. The former type are mainly variations of the bucket elevator, of which the earliest is the chain of pots. Georgius Agricola in *De re Metallica* [1556] shows a form of chain bucket elevator for mining work. Besson, a few years later, describes a bucket elevator operated by a hand crank for lifting building material.

Improvements in design took place particularly in the nineteenth century, for example the elevator boot was patented by Dodge (1887) and Peck introduced the overlapping bucket carrier (1900).

There are several types of package elevators which have many uses in industry where the frequency of loading is too high for a lift.



FIGURE 4. An overhead chain conveyor in a pottery factory

(b) *Overhead Chain Conveyors*

The modern type of horizontal chain conveyor consists of a power-driven endless chain suspended from an "H" section or other type of track by means of trolleys placed at regular intervals on the track. Suitable carriers are hung from the trolleys to carry the loads, which individually may be from a few pounds to one ton in weight. An installation in a pottery works is shown in Figure 4. The conveyor can be constructed so that any given number of delivery points may be pre-selected at a despatch point.

The pivoted bucket conveyor which Hooke showed in *Philosophical Experiments* (1692) may be considered the forerunner of the modern chain conveyor, although Hooke did not employ a chain, but a rope. An early description of a modern type was given in *Traité Complet* (1818) of Gorgnis. The history of the overhead chain conveyors is not clear and Zimmer in his last work⁹ devotes little space to it. Yet to-day these conveyors are widely used and some installations are over a mile long.

The design offers many advantages: the conveyor is flexible and between loading and unloading points can travel in the saw-tooth spaces of a roof, thus freeing the floor area.

It should be used, like all conveyors, when a continuous flow of articles has to be transported between a number of fixed points. This type is particularly useful for carrying work between and through processes, as through dipping tanks, spray booth and stoving ovens.

Industrial Trucks

Trucks are of very ancient origin. Wheeled carts occurred in Babylonia in 3,000 B.C. and simple small wheels on a scaling ladder are shown in an Egyptian painting of about 2,500 B.C. The existence in China of wheeled chariots appear at a date not very different from that at which they occurred in Egypt.

Trucks have been used down the ages for many industrial purposes. Examples in the eighteenth and nineteenth centuries often ran on rails. Iron rails appeared in collieries in 1767, and George Stephenson was one of the first to use mechanical traction in workshops in 1820. Bodmer in the 1830's laid rails in a works for the movement of material on trucks between machines.

An important development took place in 1887 with the construction of the first hand lift truck. The fixed platform truck is immobile while loading and unloading takes place. The lift (or stillage) truck has no platform, but is designed to run under a stillage, which is a platform in the form of a low table with four legs. The truck slightly elevates the stillage so that its legs are clear of the ground and thus can move it about. Any number of stillages can be used with one truck, and there is no waiting time for loading and unloading.

The first industrial battery-electric truck was produced in 1906 and was used for carrying baggage at stations on the Pennsylvania Railroad. It had a fixed platform. The battery-electric stillage truck came into use in 1914, and the same year saw the first fork truck which was used to supply furnaces. Other fork trucks were mentioned around 1915 on the Canadian Waterfront and in Liverpool. The first elevating fork truck was manufactured by Elwell-Parker in 1919. Thus was born one of the most versatile handling devices in industry, which, however, with the unit load only came into wide use in Great Britain after the Second World War. The fork lift truck combines horizontal and vertical movement and lifts by leverage. The fulcrum point is on the centre line of the front axle; the weight behind this axle counterbalances the load which is carried on the fork in front. The fork moves up and down the mast, which may be telescopic. The fork lift truck can pick up, move and stack, and thus greatly economizes in unskilled labour and storage space, making full use of 'air rights'. A good example of use is seen in Figure 5. Many special attachments can be fitted in place of the fork, for example, a ram for handling wire coils, a scoop for bulk materials or a carrier for drums.

Pedestrian-controlled power trucks made their appearance around the middle of the 1930s, and all types have come into wide use since the last war.

Industrial trucks should be considered for use where material has to be moved between a number of points which are not generally fixed, in storage areas, and when the flow is intermittent. They are very flexible in use. Care should be taken in the selection of the right type of truck and particular attention given to the planning and organization of a trucking system.

Radio control is coming into use in larger establishments, and is an excellent method of ensuring maximum utilization of the trucks and their operators.



FIGURE 5. A fork truck stacking palletized loads of soap powder

THE DEVELOPMENT OF THE INTEGRATION OF PROCESSING AND HANDLING

Mechanical handling, motion study, and process machinery were considered somewhat as separate subjects of study to the present day. Factory lay-out, too, was not considered from the point of view of handling; rather was it the other way round. A factory was laid out with other, and less important, considerations in view and equipment was put in *ad hoc*.

The classic example of the integration of the processing and the handling was the flour mill designed by Oliver Evans in which he used belt conveyors, bucket elevators and screw conveyors. The illustration in Figure 6¹⁰ shows a really wonderful conception (considering its date) which marks the beginning of a new way of thought.

Evans advertised in a broadsheet dated December 19th, 1787: 'One hand can do the work that used to employ two or three. Two hands are able to attend a mill with two waterwheels and two pairs of stones steady running, with very little assistance if the machinery be well applied. They are simple and durable and not subject to get out of repair. If millers will think on this when they are fatigued carrying heavy bags, or with hoisting their wheat or meal, spreading to cool, and attending the boulding-hoppers, screens and fan, and when they see the meal scattered over the stairs, etc., wasting, or when they hoist their tail flour with the bran to bould over—and when their flour is scraped for neglect in

boulting, and when the superfine is let run into the middlings by overfeeding, etc., etc., and consider that these machines will effectually remedy all this, and save great expense in wages, provisions, brushes and candles, he may conclude that it is not best to continue in the old way, while such excellent improvements are extant'.

The beginnings of flow working were seen in this country around 1800. At the Deptford Victualling Office a close study was evidently made of the correct sequence, timing and siting of processes. The handling between the processes and the work of individual operators were also carefully planned.

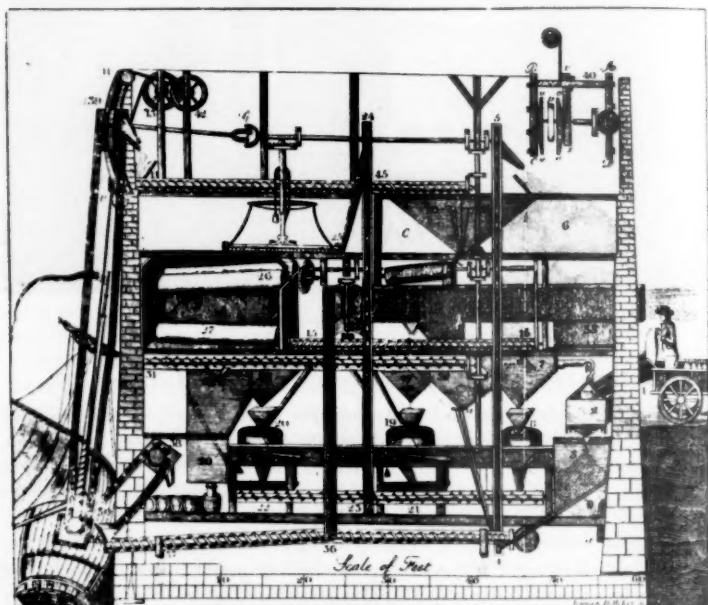


FIGURE 6. A plate from Oliver Evan's book *The Young Millwright*, 1795, showing the complete integration of the processing and handling, in a flour mill

Careful consideration was given at De la Rue's factory to the handling in relation to the processing in the manufacture of playing cards, particularly with regard to hand movements. Of this factory it was said, too, in 1846 that 'the more machines Mr. De la Rue introduces into his workrooms the greater is the number of hands he requires to employ'.

J. G. Bodmer laid out a factory (Chorlton Mills, Manchester, c. 1840) in which the processing and handling were considered together. Cranes and other handling

devices were so arranged that machines could easily be fed and the operators were in fact serviced in the modern sense. He also carefully planned the lay-out of the machine tools to minimize the handling.

The activities of Woolwich Arsenal have already been mentioned, and the next significant step took place in the Middle West Slaughterhouses in the United States about 1850. Lines of overhead runways were installed and as the hogs passed along each line operators chopped off specific parts from the carcasses, which were completely dismembered by the end of the line. This lay-out was in principle an assembly line in reverse, but it was not until 1912 that Henry Ford brought the assembly line into being. Instead of parts being carried to a central position for assembly, the main components passed along a line and the subsidiary parts came to meet the moving main line parts in a similar manner to the tributaries coming to meet a river. It was Henry Ford's conception to place the tools and the man in the sequence of operations. Thus work was moved to the man and from one process to another by chutes, conveyors and other devices with the man standing still.

This idea was actually first carried out on sub-assemblies, such as engines and magnetos, and some little time elapsed before the chassis were also made to move first of all by means of a 250-foot length of rope which pulled them along the floor. The complete assembly line was not in full swing until 1915. The first fully synchronized and automatic assembly conveyor was perfected about 1920.

The present stage in the development is 'automation', which can be defined as the complete automatic and selective transfer of a part from one process operation to another. Thus automation includes both automatic unloading of one machine and automatic loading of the next. This conception of course brings the automatic factory very close indeed and is the result of the complete blending of the processing and the handling.

CONCLUSION

It must not, however, be thought that the idea of blending the processing and the handling only applies to very large establishments with high outputs. It applies to all sizes of concerns, and even to the home, an illustration being the disposal of domestic waste by means of a Garché system or an 'under the sink' disposal unit.

Establishments with large outputs have always required some methods of handling and for this reason they have been considered in the historical survey. Whether the right methods were adopted is sometimes open to question, but the point is that some material handling ideas were employed. The need in the smaller concerns is not so apparent until a study of the particular works has been made.

Again, some matters have not been considered here, for example the applications of electronics or the mathematical treatment of particular situations. Such subjects require a detailed treatment and have been omitted so that as much general ground as possible could be covered.

Improvements in productivity in British industry will depend, *inter alia*, it is suggested, on the following:

- (1) A proper appreciation of materials handling and materials processing by management, foremen and operators.
- (2) More importance being attached to planning, organization and designing for production.
- (3) More qualified engineers being employed on the production side, particularly on the shop floor.
- (4) Production research being given the same status as pure or product research.
- (5) University Engineering Degrees including industrial production subjects in the final years.
- (6) Higher degrees being awarded for research in industrial subjects, such as materials handling and management studies.

DISCUSSION

THE CHAIRMAN: I think we have had a very interesting and most valuable lecture, and there is evidence in it of a great deal of research into ancient history and a very detailed knowledge of modern methods.

The reference to the methods of production of shells which 'never touched the ground', at what, I suppose, is now Woolwich Arsenal, put me in mind of a visit of mine some time in the 'thirties to one of the prominent engineering firms which was making those little shells for the naval pom-pom which fired some hundreds of rounds a minute. I knew nothing about industry in those days, but I expected to see a continuous line of these shells popping in and out of machines. They were, however, being taken about a very rough and bumpy floor by a lot of little boys with wheelbarrows. It seems to me now that we took rather a long time to get very far in advance of what Woolwich Arsenal were doing in 1854.

The lecturer referred to a continuous lift. Possibly I have got his point wrong. My earliest recollection of a lift is going as a small boy into the city with my aged grandfather. We arrived at a building and had to go up to the top floor. He explained that the technique was that you dived into the lift as it went past; we made a wild rush and just managed to get in. As we went up very slowly he explained to me that unless I was very careful to jump out at the sixth floor I should go over the top and down the other side upside down.

Coming to modern times, I referred to the interest of our organization, the British Productivity Council, in this question. About four years ago, during the early days of the existence of the Anglo-American Council, we sent a team over to the United States to study what they were doing there. I think that, in fact I know from the demand we get for it, that their Report is still of great interest. The team emphasized how much more materials handling was studied and developed in the United States than it is here, and, of course, as we all know, their productivity, however you may qualify it, is something like twice ours. I think there is obviously some relation between those two things, but the thing of most interest to me was that some of the team said that their friends in America told them they felt they had only just begun and they had still got an enormous way to go.

Another important point made by that team was that something like fifteen to eighty per cent of the cost of production was in handling the materials, components, finished products, and so on.

We published that Report. We produced a pamphlet afterwards and, not very long

7TH AUGUST 1953

MATERIALS HANDLING AND PROCESSING

ago, some illustrated case studies of materials handling. It shows the way things are moving in this country. At that time, four years ago, there appeared to be practically no current literature on the subject, except for one or two books we got from the United States. At the present time, the field is fairly well covered, and Mr. Landon Goodman's book is, I suggest, a notable contribution.

MR. A. C. WILSON: I noticed the lecturer talked quite airily of the qualified engineers on the shop floor. I should like to ask him what he means by 'qualified engineers'.

THE LECTURER: The term 'engineer' is unfortunately used very loosely to-day, so I like to use the term 'qualified engineer'. He is a man who has served an apprenticeship, has undertaken a satisfactory course of study and passed the course examinations, and has held a responsible position in industry for several years. In other words, it implies sufficient qualifications for corporate membership of one of the three senior engineering Institutions.

I was not too happy when the Chairman said that in 1948 there was no literature available on materials handling. There was a wealth of literature available but it was technical. One of the greater books on the subject was Zimmer's. Zimmer wrote from about 1903 to 1935. He also contributed to papers like *The Electrician*. In 1917 there was a whole edition of this paper devoted to the handling of material. Cassiers were running *The Conveyor Supplement* at the beginning of the century.

MR. W. H. BICKLE: The Chairman made a recommendation that a study of productivity should be carried out by all industries, or by as many as possible. Considering that three quarters of the industrial firms in this country have less than a hundred employees, and it is doubtful whether many of these can afford to have an 'engineer on the floor', I think it is the case that many small firms have very little or no provision for getting information disseminated among the staff; that is, there is no particular person whose business it is to obtain information and to see that it is applied. In addition, many firms have only the haziest idea where to go for information. The Chairman has just said that during the last four years a good deal of literature has accumulated on the subject of this meeting, and I wondered whether any attempt has been made to bring this information to the notice of the smaller firms, many of which, I imagine, have no idea that such information exists.

THE LECTURER: I rather like to approach this problem from another angle. I ask 'Can a small firm afford not to employ a qualified man?' These questions are often a matter of economics. Firms and companies are in existence to make profits.

The questioner mentioned a hundred employees. Now, I know of one or two firms which employ five qualified men out of a staff of about a hundred; staff includes management and operators. Companies just cannot afford not to investigate the possibility.

There are also certain specialized services, which I admit are sometimes expensive. There is the consultant. A second is the Trade Research and Development Associations.

I am a great believer in the trades getting together and, shall we say, employing one or more men themselves. If they are in farming, a number of farms grouping together, employing a good man and sharing his services between them. I think that can be done; I do not mean only by a national organization, it could be done on a district level. If three or four firms realized this—they may be of rather widely different types, that does not matter—they could employ a good man.

The question of where to go for information is not easily answered briefly. There are the Institutions, Research and Development Associations, libraries and bibliographies issued by the various institutions. There is often much experience in the local technical societies. It is surprising how much information is freely available. The

British Electrical Development Association, for example, has published much material which would be of interest to Mr. Bickle.

MR. J. R. BRIGHT (Editor of the American Journal, *Modern Materials Handling*): It may be of interest to know that the earliest recognition of mass assembly goes back to the Phœnicians when they built galleys. The method of equipping them was to float them down the canal. On either side of this were houses from which the galleys' equipment would be passed into the boat as it went past. The one area the lecturer did not touch upon, but which might be worth speaking about, was railroads. The building of railroad cars was, perhaps, the first recognition of specialized assembly. At first they used to build them in gangs; each crew would build its own car from start to finish. I think about 1890 they began to start specialized assembly, each crew having a different function as the car went by them. To our surprise we found that the beginnings of mass assembly did not start with Mr. Henry Ford but Mr. R. E. Olds, who in 1906 was the first man to try to put together a product by a mass assembly technique, although he did not use a conveyor. He used carts loaded with an assembly of components for engines, and he pushed them by his lines and assembled his engine by these trucks.

As for the future, we are seeing something else happening in the States, and actually I would say that not one out of ten in the business realizes it, except for some of the more astute ones. The conveyor is no longer a means of transporting things from here to there; it is becoming the basic production machine in the factory. And I say production; I do not mean materials handling machine, I mean production machine. It initiates action, it puts raw materials in, starts processing, stops it, transports the materials to the next stage of processing and so on. That, of course, is being done only in certain plants and there are only a few examples of it, but the recognition is there and, I am sure, it is the key to the future.

I agree with the lecturer about keeping the floor clear. Some examples we see in the United States are terrible. The best plant I know of in this respect is De Soto's new engine plant, where all the handling is done from the ceiling. They use the mono-rail system combined with power trolley conveyors. They have a continuously running conveyor but you can cut units off into a gravity run by each machine tool and do your work there. Everything hangs from the ceiling, bins, valves, stems, pistons and so on, and the floor is beautifully clean because there is nothing on it. I asked them why they made such a point of that and they said it has done marvels to their inspection costs.

In the belt conveyor field we have seen something very interesting happen. In the last six years the belt conveyor has challenged and beaten a railroad on common carrier costs on the Bull Shoals Dam in Arkansas. They had to move a mountain of rock seven miles. The belt conveyor was compared to a fleet of thirty-five giant motor trucks. The initial cost is a trifle higher but the operational costs were only seven men night and day. When the job was done the belt was sold for forty per cent of the cost.

An Ohio corporation has tried to replace a good deal of the railway for hauling coal from the coalfields to the lakes, and from the lakes down to the steel mills. This conveyor, it is believed, would save from 85 cents to \$1.50 a ton. It would operate night and day, and I think the belt—there have been various propositions—would be in the neighbourhood of 4 ft. to 6 ft. wide and 108 miles long, and enclosed in a giant tube. It is absolutely practical. The belt conveyor people are prepared to back it with their own money. The railroad interests are fighting bitterly in the Ohio State Legislature and it has been defeated two sessions in a row by one vote.

There are a number of areas in which our thinking is very weak. For instance, you are campaigning at this point for recognition of the unit load idea. We have succeeded in this in the United States, but the question now is, what is the right load? Should it just be a load as big as the machine will carry, or

should it be a load of the size, for instance, of a common selling unit, a gross of material, or a ton of material? The optimum load is that which will be best at the point of use. In other words, the vendor fills the unit container with a precise number of units and this would be used at the point where the user wants it; not where it is in the store house, but where it is on the production lines. So there would never be any rehandling. I think that idea is going to take hold eventually.

We also see something else coming in, that is handling in bulk. There is the question, why handle in containers at all, why not bring in car loads and pump them in the plant to the point of use? Consider the world's largest bakery at Overbrook, Pennsylvania, where they unload car loads of flour at the rate of 20 tons an hour, and put it into any one of 24 silos. By press-button mixers they add sugar and salt and so on, move that to the ovens automatically, out of them automatically, into slicing machines, wrapping machines and move it down to the trucks ninety minutes from the time they started. They have the thing so mechanized they had to get rid of their bakers and put engineers in. They told me it was easier to make bakers out of engineers than to make engineers out of bakers.

A speaker mentioned the size of materials handling costs. I have a few facts here from a Westinghouse study in 1948. Westinghouse took every operation in a great number of plants and broke them down into basic elements, for instance, single point turning, de-burring, soldering, wiring, multiple point turning, materials handling and a few other things. To their astonishment they found they spent more man hours on materials handling than on any other thing.

Then they asked themselves this question: Are the number of engineering man hours we devote to materials handling consistent with the number of engineering man hours we devote to these other functions? The answer was a resounding no. They are trying to do something about that.

I would like to comment on Mr. Goodman's suggestion as to what small plants can do. Your trade associations should get together and get a good consultant to study what should be done in your particular field.

THE LECTURER: With regard to Mr. Bright's remarks on the right size of the load, I think that that can only be decided by research. I do not think it can be decided by one man just following the process through, but only by very intensive work and with a bias towards the mathematical and economic approaches.

Bulk handling is being developed in this country. There is one firm of cement manufacturers which is using bulk handling for cement delivery. They have found, and they are not a very large company in the cement field, that they saved £100,000 in the first year by doing away with sacks and all the things that sacks entailed, and using tankers to deliver the cement into their users' tanks.

The number of man hours devoted to materials handling is tied up with this question of who is responsible. I am not in favour of a man, even in a small organization, having too many varied responsibilities. A man can be pulled between the various loyalties. Take the case of the man who is in charge of production and also is works manager. Will his production side be stronger than his management side? His works management duties imply that he is responsible for maintenance, but the production side means he has to keep the machines running and few men can balance those two responsibilities correctly. I do not think it can be done well by one man with two or three other functions. That is my own observation over some years in this field.

Books, papers and journals are not the complete answer for the industrialist, though they are valuable. Too much is written for parrots by parrots to-day. Somebody sees an article and says, 'By Jove, an editor will accept that', and goes off and writes another similar article, without any practical experience of the subject matter. Practical experience at a creative age, combined with theory, is necessary. When a boy

is young he gets a sense of feel for these matters and he cannot develop it at a later age by reading alone; he has to have practical experience on the job. I do not think any number of text-books will help him to learn management, or will help him to get a grasp of materials handling, materials processing or machine tool applications. I feel very strongly on this point; too much is written and too much is incorrect in its practical applications.

MR. J. M. BESKINE, B.Sc. (ENG.), A.M.I.B.A.E.: First, I feel it should be stated that there is a British Journal dealing with this matter—*Mechanical Handling*—and there is also an Institute of Materials Handling which is attempting to carry out practical work. There is also a School of Materials Handling: I have been to its lectures and know that it is doing some very valuable work.

With regard to processing, there are two aspects I should like to bring up after looking at the interesting historical slides. I felt that so much that is regarded as modern is really ancient, at least in principle. Then I remembered one of the few new things I have seen for a long time. This was a development in processing conveyor design, where, instead of work being passed through a long tunnel, it is passed round a tight spiral. I mention this because I feel that there are new ways of attacking old problems, and that the 'theory man' has got a lot to give the practical man.

Another point I want to mention—and I feel it is important because nobody has said anything about it, and people are spending and losing money by not paying attention to it—is the need to pay more attention to health protection. More use should be made of mechanical handling for the remote control of dangerous materials. I am not thinking of the new hazards such as radiation diseases; they are very obvious. There are older hazards; for example, in foundries, in the handling of sand, and in shot blasting. I think tens of thousands of pounds are being spent annually on damages to members of the foundry professions. Workers in the foundry industries are often working in highly mechanized but highly unhygienic factories; they are being awarded damages for injuries and I think they often deserve greater damages. The point is this, that if the manufacturers, the men who design and order processing equipment and find the money to invest in new designs, were to stop and think for a moment, they might see their way clear to sponsoring the development of foundry equipment which really safeguarded health and which would in fact be extending machine tool design to foundry and other work.

For example, in shot or sand blasting, castings could be loaded into a machine from roller conveyors, placed on gimbals within the machine and the work passed under or around a series of nozzles each of which would be designed to carry out a particular group of operations. The whole machine would be for production; the operators would be outside it and the dust would never get out of it. It would cost a little money to develop, but I think it would pay for itself.

THE LECTURER: I am very interested in your remarks. There is much that is considered modern that is ancient, as I showed in my paper. I am wondering whether spiral processing is not ancient.

As regards protection of health, I could not agree more. The answer is not always provided by mechanical handling equipment but quite often it is. Remote control, multiple production and economics all go together. There is one other factor involved which I suggest is not always present in industry to-day, and that is the necessary knowledge. It takes a great amount of knowledge to design a machine of the type just mentioned. It takes much experience, not only of machine design, but of processing and the design of the product. The market and sales too are all bound up; sales are a function of materials handling and sales development is a function of materials handling too.

MR. A. MORGAN, M.I.E.E.: The biggest lesson to me in the lecture and slides was the extraordinary fact, which is being denied all over the world, that labour is the

sole source of wealth. We have had a demonstration this afternoon that greater production with increase in wealth is due to elimination of labour. A moment's insight is worth an eternity of toil. The machinery we have had demonstrated to-day is a proof that we have a golden future in front of us if material things are the foundation for it, and if we will only recognize and understand that manufacturing is ninety per cent lifting and carrying. I have found, as an engineer of some standing, that during the whole of my lifetime the workman is not the man that obstructs. I have always found that wherever a labour-saving machine is put in, such as a lifting machine, we are taking some slavery out of the man's job; and wherever we have produced greater wealth, it has resulted in more employment under better conditions. For example, the production of motor cars over many years did not affect the employment of labour in the horse carriage vehicle industry.

Our wealth and comfort in the future lie in doing the job better and in a more scientific manner. To my mind philosophy in design is a matter which needs exploration, and more than there is to-day. It is the weather vane, the pointer as to where we are going. During the whole of my life people have come to me, even my competitors, and I give them the information as freely as I can. I remember a case where one of my own customers allowed me to examine his costs. I found that this man, who was saving up his work to lift by his steam crane and was baling his sacks with a steam plant, was spending 25s. 6d., while other men are spending 5s. We even went to the point of offering to finance him, but that did not work; he just did not understand.

A vote of thanks to the Lecturer was then carried with acclamation; and, another having been accorded to the Chairman, the meeting ended.

The following contribution to the discussion has been received since the meeting at which, owing to shortness of time, there was no opportunity to make it.

MR. G. VIVIAN DAVIES, F.INST.F., A.M.I.MECH.E.: In my experience there are few firms, however small, who have not at least one qualified engineer of one type or another. The difficulty is that these men, generally speaking, just do not take the trouble to find out what mechanical handling can do for them.

It has been suggested that it is difficult to obtain such information, but this is sheer nonsense. There are excellent journals devoted entirely to this subject and mechanical handling exhibitions have been held regularly for some years, and many papers have been read on the subject.

Reference has been made to consultants but many firms in this country are opposed to the use of consultants, particularly those specializing in a single field. I believe that engineering and industrial consultants should study the subject and thus be qualified to advise their clients.

With very few exceptions such as fork truck manufacturers, the makers of mechanical handling equipment in this country have shown a singular lack of initiative in developing new applications. I have got users interested in at least two special applications, but I have failed to arouse a corresponding interest from the makers of handling equipment. In one case the application is extremely simple, and the device cheap and easy to manufacture, but although I could sell it, I have, so far been unable to get any firm to consider making it. They prefer to go on churning out roller conveyors which, although useful in themselves, are not the only devices for handling goods.

A good deal could be done to cut out unnecessary handling by better factory lay-out and the movement of goods in process along a level convenient to the operators. On the subject of overhead conveyors, one firm told me that they adopted this method because it enables them to suspend materials for which they would otherwise have

to find valuable floor space. In fact, their overhead conveyors are regarded as an extension of their stores.

Lastly, a fortune awaits anyone who can devise a means of handling coal, and other minerals, without creating dust. Pneumatic methods have been tried, but so far with only very limited success.

REFERENCES*

1. *Electronics in Materials Handling*, by L. Landon Goodman, Mechanical Handling Convention, London, 1952.
2. *Technics and Civilisation*, by Lewis Mumford, 1934.
3. *Dynasty of Ironfounders*, by Arthur Raistrick, 1953.
4. *The Pyramids of Egypt*, by I. E. S. Edwards, 1947.
5. *Ancient Egyptian Masonry*, by S. Clarke and R. Engelbach, 1930.
6. *Nineveh and its Remains*, by H. Layard, 1854.
7. For further details see *More Mechanical Handling for Greater Productivity*, by L. Landon Goodman, E.T.A. Conference, 1951.
8. *Theatre des Instrumens*, by J. Besson, 1578.
9. *The Mechanical Handling and Storing of Material*, by G. F. Zimmer, 1932.
10. *The Young Millwright*, by Oliver Evans, Philadelphia, 1795.

GENERAL NOTES

BRITAIN IN AFRICA

The Joint East and Central African Board has published recently a small booklet entitled *Britain in Africa*, which describes the work and policy of the Board since it was formed in 1926 at the suggestion of the then Under-Secretary of State for the Colonies. The booklet also contains some useful information on the historical background of the East and Central African territories.

Before 1939 the main task of the Board, which is non-profit making and non-party, was to provide a form of unofficial representation in the United Kingdom for resident European communities in the East African colonies. In 1948 the Central African territories were included and the name changed accordingly. Notwithstanding that as the territories' political stature has increased they have become more than capable of undertaking many of the responsibilities which previously it had tried to fulfil for them, the Board considers that to-day there is much it can still do to help, and in particular is concentrating on the questions of economic development and of race relations. In the last few months, it has decided to extend its sphere of work to include the Sudan.

The prime purpose of the Board remains to maintain and strengthen British influence in Africa. Its members are drawn from industry, agriculture, politics, commerce, finance and journalism in the United Kingdom and Africa, and it has been recognized by successive United Kingdom Governments as a source of responsible advice on political and economic affairs.

Apart from its official and unofficial contact with Governments in the United Kingdom and East and Central Africa, the Board keeps in close touch with commercial and educational organizations in the territories concerned, and keeps its members informed of its work by a monthly news letter.

Copies of *Britain in Africa* and details about the Board's work and conditions of membership may be obtained from its registered offices at 25 Victoria Street, London, S.W.1.

NOTES ON BOOKS

ENGLISH ART, 871-1100. D. Talbot Rice. (*Oxford History of English Art, Vol. II*) Oxford, at the Clarendon Press, 1952. 37s 6d

The *Oxford History of English Art* is beginning to be a series. Two volumes have

*The author would be glad to hear from any reader who may have further historical information about the subject discussed in his paper.

now been published, and at least three others are known, at all events to their authors' friends, to be well under way. The second volume, both in numbering and in order of publication, covers English art from 871 to 1100, and is the work of the Professor of the History of Art in the University of Edinburgh. He may be congratulated on having successfully faced a difficult task, though one as fascinating as it was difficult.

In England, where the marks of Roman domination were, at the end of the Dark Ages, less visible both physically and spiritually than they were in France or Germany, the new dawn of a coherent civilization broke through clouds that were indeed dark. That civilization was essentially Christian, and its art was essentially Church art. Except for the Godwin seal (Plate 36d) on which God the Father and God the Son are represented; a bone plaque with griffins (Plate 38a) which may as well have formed part of a reliquary as of a secular coffer, and four enamelled ornaments (Plate 92) of which two are not wholly English, there is no secular work included in the rich illustration of the book, for the excellent reason that such work does not survive. It is copiously represented in the pagan Anglo-Saxon period; but the Christian prohibition of the burial of a man's goods with him explains the rarity of surviving examples of secular work in the Christian period. The English reputation, even on the Continent, for excellence in embroidery and goldwork makes us regret the lacuna yet more.

Professor Talbot Rice starts the main part of his book with a chapter that links the art of his period with the general historical background: the delayed impact of the Carolingian Renaissance on England, the effects of the Norse invasions, and the influence of the great men of action of the period, with Alfred at their head, and of the great clerics, St. Dunstan, St. Æthelwold and St. Oswald. He then studies the question of the relation between English and Continental art, especially in the field of illuminated manuscripts; and thence proceeds to a study of later Anglo-Saxon and early Norman architecture, especially in relation to the architecture of the Continent.

The rest of the book is taken up with accounts of specific arts in the later Anglo-Saxon period; sculpture and manuscripts in particular are treated in detail. A final chapter stresses Professor Talbot Rice's general conclusions: that English art was influenced by the Continent more than is usually admitted from the time of Alfred onwards, and as much, if not more, from Mediterranean as from Germanic sources; that the importance of Northern influences on later Anglo-Saxon art have been exaggerated; and that "the essential character of later Anglo-Saxon art was above everything else its Englishness. It was not merely an eclectic art, the outcome of a hotchpotch of casual influences from the past and from outside; it constituted rather a clearly defined and quite original style with a definite character of its own".

No one who studies Professor Talbot Rice's plates can deny their strong and characteristic style; and no one who is interested in the development of England as a whole—constitutional, social and artistic—can afford to neglect his book. The *Oxford History of Art* has become a series.

JOAN EVANS

SHORT NOTES ON OTHER BOOKS

THE INFLUENCE OF THE CINEMA ON CONTEMPORARY AUDITORIA DESIGN. *By Clifford Worthington. Pitman, 1952. 25s*

This discussion of the architecture of the cinema covers planning requirements and the choice of a site, plan and construction, acoustics and visual requirements, and equipment. It is illustrated by reference to cinemas built between the wars, with photographs, drawings, diagrams and plans, and there is a bibliography.

MONEY. By J. L. Hanson. *English Universities Press*, 1953. (*The Teach Yourself Books*.) 6s

This new addition to a useful series opens with a brief account of the history of money as coins and notes, and then discusses its wider meanings; sections of the book deal with the value of money, money and economic activity, and international monetary problems.

THE WAY OF WOOD ENGRAVING. By Dorothea Braby. *Studio Publications*, 1953. (*How to do it series*, no 46.) 18s

This latest addition to the *How to do it* series is, as usual, very fully illustrated, so that every point is explained visually as well as in the text. As well as the diagrams and the prints showing the progress of an engraving, there are a number of examples of the work of different artists, illustrating different effects that may be obtained.

A BOOK OF GREEK COINS. By Charles Seltman. *Penguin books*, 1952. (*King Penguin book*, no 63.) 4s 6d

The 117 coins illustrated in this book are described, and their meaning explained, in an introduction which also relates them to the art and commerce of ancient Greece. There is a map, and a list of other books on the subject.

BRITISH SOURCES OF PHOTOGRAPHS AND PICTURES. Edited by G. W. A. Nunn. *Cassell*, 1952. 17s 6d

The list of sources in this useful book includes photographers and photographic agencies, libraries, museums and art galleries, dealers, journals, and publishers, and 'special sources'—a heading which covers bodies ranging from the Alpine Club to the World Ship Society. Addresses and telephone numbers, and details of the material available, are given in each case, and there is a good subject index.

FROM THE JOURNAL OF 1853

VOLUME I. 5th August, 1853

From Miscellanea

FRENCH COMMERCIAL LAW.—The following decision was lately made by the Tribunal of Commerce for the Department of the Seine. It appears that a number of cafés had been established in the neighbourhood of the "Cirque Napoléon". The proprietor of this theatre being desirous of favouring one of the cafés, gave permission to Foubet, the landlord of it, to name his establishment the *Café du Cirque Napoleon*. Marchetti, the landlord of one of the neighbouring cafés persisted in calling his establishment by the same name, which he had previously adopted. Proceedings were then taken by Foubet against Marchetti to prevent the use of this name by him. Whilst these proceedings were pending, by some process known to the French law, Queranne and Commissaire, landlords of another café, interposed, and set up their right in the action to use the name, and claimed 5,000 francs damages. The court, after hearing all parties, and it appearing that the proprietor of the theatre was in no way concerned in Foubet's business, held that he had no power to authorize Foubet exclusively to use the name of his theatre, that the right to use the name was vested in the person first adopting it, and that neither Foubet nor Marchetti was entitled to its use, but that Queranne and Commissaire had the right, it being proved that they had been the first to use the name. No damages were awarded, as it did not appear that any had been sustained, but Foubet was condemned in all the costs.

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